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A FLORISTIC INVENTORY OF MANATEE SPRINGS STATE PARK, LEVY COUNTY, FLORIDA

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ABSTRACT. A floristic inventory of the vascular plants of Manatee Springs State Park in Levy County, Florida, was conducted from May 1996 to December 1998. In the 933 ha (2305 acres) park, a total of 360 species was found. The vascular flora comprised 8 ferns, 1 cycad, 6 conifers, and 345 angiosperm species representing 90 families and 241 genera. Twelve natural communities are recognized in the park in addition to ruderal and developed areas: upland mixed forest, xeric hammock, sinkhole, sinkhole lake, swamp lake, basin swamp, bottomland forest, depression marsh, floodplain swamp, floodplain forest, blackwater stream, and spring-run stream.

Key Words: Florida, flora, floristic study, vascular plants

Manatee Springs State Park is located seven miles west of the city of Chiefland in Levy County, Florida, with the Suwannee River forming its western boundary. The park occupies Sections 13, 23–26, 35, and 36 of Township 11 South, Range 13 East. The total area of the park is 933 ha. This includes the Meud-Scot track to the south acquired in 1988 (Department of Natural Resources 1989). The park is managed by the Division of Recreation and Parks for public outdoor recreation. The beautiful artesian spring, named for the manatees that take refuge there, is the major recreational feature of the park. Swimmers and divers enjoy a deep blue spring boil surrounded by bald cypress. Camping facilities and nature trails are also provided for exploring the park. The Suwannee River, as well as all other surface waters in the park, is designated as Outstanding Florida Waters (Department of Natural Resources 1989).

The flora of this area has not received as much attention as that of the panhandle or Southern Florida, and the geographical range of some species is poorly known. Many northern species find their southern limits in the Suwannee River region. This study was conducted in order to provide a detailed checklist of the park's flora, as well as descriptions of its plant communities, which will be valuable in future management of this state park.

Climate. Northern Florida typically has a humid, subtropical climate (Winsberg 1990). Positioned in the northwestern portion of the Florida peninsula, Levy County experiences both the warming effect of being south of the jet stream in the winter and the cooling effect of the nearby Gulf of Mexico during the summer. Average annual maximum daily temperatures are 78°–80°F, while average minimums are only 55°–56°F.

Winter is mild with 20–30% of days between December and February receiving temperatures above 75°F. Cold fronts from the interior United States regularly affect the temperature, however. Around 40% of days between December and February have minimum temperatures below 40°F (Winsberg 1990). Most winter rainfall is the result of these fronts, but on average, winter weather brings less rain than summer (Chen and Gerber 1990; Jordan 1985).

Spring weather usually arrives in March. The polar jet stream passes farther north, and the days are warm and dry. In May average daily maximum temperatures exceed 88°F. Nighttime temperatures rise, and rainfall increases. Afternoon thunderstorms are common by June. These take place an average of 80 days per year, making summer the wettest season. Annually, this region receives an average of 152 cm of rain (Winsberg 1990).

Geology. The park is situated in the Ocala Uplift District as part of the lower basin of the Suwannee River. The Ocala Uplift was formed during post-Oligocene orogeny and has little Miocene sediment. However, there are large outcrops of Eocene and Oligocene carbonates present at or near the surface (Brooks 1982; Vernon and Puri 1964). Oligocene deposits, usually Suwannee Limestone, are not present in Levy County (Department of Natural Resources 1989).

The oldest tertiary sediments in the area are part of the Paleocene Cedar Keys Limestone. This formation is a hard, cream-colored to tan limestone with a thickness of 168 to 183 m and was formed in the open ocean when the coastline was located across what is now Alabama and Georgia (Cooke 1945).

Over this layer, several Eocene limestone deposits common to the Ocala Uplift can be found. These limestones can be divided into three age groups: the Wilcox, Claiborne, and Jackson groups from oldest to youngest (Cooke 1945). The Oldsmar Limestone belongs to the Wilcox group and contains gypsum and chert

(Cooke 1945). This deposit is 122 to 168 m in thickness. Two deposits of the Claiborne group are present in the area. Lake City limestone is the older and consists of both dark-brown and chalky limestones with some gypsum beds. Cooke (1945) reported this layer to be around 152 m thick in Levy County. Above this layer is Avon Park limestone, a cream-colored deposit with some gypsum and chert embedded in it. This limestone may be anywhere from 15 to 91 m thick (Cooke 1945).

The youngest age-group of Eocene limestones, the Jackson group, is represented by the Ocala group, one of three limestone subgroups comprising the layer. These are, from oldest to youngest, the Ocala, Williston, and Inglis members. These form a layer that is around 60 m deep. This limestone is exposed around the main spring and is mined for road construction in Levy County (Department of Natural Resources 1989).

The entire coastal region of Florida lies in the physiographic region called the coastal lowlands, an area that was covered by the sea during the Pleistocene. The ancient shorelines formed several terraces, of which the Pamlico is the most extensive (Cooke 1945). This shoreline was located at 8 m above current sea level. Elevations within the park are from 8 m above to 1.5 m below sea level. The deposits of this age are mostly sand, but may also contain some clay (Cooke 1945).

Sinkholes are common in the park. The abundance of limestone underlying the park is primarily responsible for the karst topography found there. Karst is a landscape formed by the action of dissolving carbonate-rich rocks, which form numerous sinkholes and caves (Myers and Ewel 1990).

Because the limestone in the Ocala Uplift District is only thinly covered, solution sinkholes are the most common type formed within the park. Surface water seeps through the rock through cracks and gradually dissolves the surface limestone, forming depressions over time. This is in contrast to collapse sinkholes, which form after the underlying bedrock has been dissolved and the roof of the cavern formed collapses under the weight of the overlying soil (Beck and Sinclair 1986).

Hydrology. The primary feature of the park is the spring, which empties into the Suwannee River. This area has felt the most impact of human influence. The spring is a popular swimming hole, and crowds of visitors are common in the summer

months. In addition to swimming, scuba diving is a frequent activity in the spring boil as well as in Catfish Hotel, a nearby sinkhole, which connects via underground passageways to the main spring (Department of Natural Resources 1989).

Manatee is classified as a first magnitude artesian spring. This means that the average discharge must be at least 2.83 $m^3\ s^{-1}$ (100 $ft.^3\ s^{-1}$). Manatee discharges an average of 5.13 $m^3\ s^{-1}$ of hard fresh water into a pool 30 m in diameter and 14 m deep at the center (Rosenau et al. 1977). This water maintains a stable average temperature of 22.0°C year-round (Myers and Ewel 1990). The warm temperature attracts manatees into the spring during the winter months (Department of Natural Resources 1989).

The spring water travels 381 m westward and empties into the Suwannee River. Classified as a blackwater stream by the Florida Natural Areas Inventory (1988), the Suwannee forms the western boundary of the park. Blackwater streams are characterized by high levels of tannins, particulates, and organic matter from swamp drainage. The pH is 4.0 to 6.0 unless influenced by groundwater (Florida Natural Areas Inventory 1988). Beck (1965) classified the Suwannee as a calcareous stream, mostly of spring origin, and having a pH level of 7.0 to 8.2. Both classifications are probably applicable where the spring run meets the Suwannee. While the river originates from swamp drainage and has a dark tannin color, it also receives heavy influence from Florida springs, such as Manatee, that make it locally more calcareous and clear. This river discharges into the Gulf of Mexico, located only 24 miles southwest of the park (Department of Natural Resources 1989).

The Florida Aquifer is largely uncontained throughout this region, meaning that much of the water is not separated from the atmosphere by impermeable rocks or clay beds (Lane 1986). This contributes to the formation of numerous seeps and flooded sinkholes, which can release water. During floods, however, the aquifer may recharge through these openings (Myers and Ewel 1990).

There are several permanently flooded sinkholes that provide access to an extensive aquatic cave, which is also accessible from the spring. These are Catfish Hotel, Freedman Sink, and Sue Sink. Catfish Hotel is the most commonly used point of entry besides the spring. This sink is 38 m in circumference and 12 m deep. Divers have explored around 3978 m of this system, but further

exploration may be dangerous due to the unstable nature of the caves (Department of Natural Resources 1989).

In addition to flooded sinks, the park also contains several sinkhole ponds and a 3 ha sinkhole lake, Graveyard Pond. Close to Graveyard Pond is a 5 ha swamp lake, Shacklefoot Pond. These are located in the northeastern quarter of the park (Department of Natural Resources 1989).

History.

> "About noon we approached the admirable Manate Spring, three or four miles down the river. This charming nymphæum is the product of primitive nature, not to be imitated, much less equalled, by the united effort of human power and ingenuity! As we approach it by water, the mind of the inquiring traveller is previously entertained, and gradually led on to greater discovery. . ." (Bartram 1791).

The naturalist William Bartram was entranced by the beauty of this spring on the Suwannee River. His admiration was undoubtedly shared by the many Indians and Europeans who traveled by or gathered beside this natural fountain. While there is not much information available on the overall history of this land, evidence suggests that the Manatee Spring region has been inhabited by Indians, visited by early explorers, and settled by Florida pioneers (Gulledge 1999).

Manatee Spring was visited by William Bartram in 1774 as he traveled through Florida when it was under British control. He described the flora as being dominated by live oaks, red bay, and magnolias. Manatees, fish, and alligators were abundant in the spring run. Indian activity was noted by the presence of a manatee skeleton on the banks of the spring, indicating that the Seminoles probably valued the area as a source of meat. The flora and fauna does not seem to have changed much in the 200 years since his visit. The flow of water from the spring, however, was quite interesting at that time. Bartram's account is of an intermittent ebullition from the spring, which occurred every 30 seconds (Bartram 1791). The hydrology has changed such that the water now flows continually.

Around the turn of the century, longleaf pine was logged throughout much of the area (Department of Natural Resources

1989). The effects of this destruction are still evident in the plant composition of the park.

In 1949, the majority of Manatee Springs State Park was acquired by the Park Board for use as a state recreational park. Additional land was added up until 1988. While public recreation is the designated use of this park, management has been designed to minimize the impact of humans. The addition of paved walkways around the spring, a wooden boardwalk along the spring run, and camping facilities in the park were inevitable, and accommodate the many people who enjoy this park (Department of Natural Resources 1989). Over time, however, the area's status as a protected natural area will help to ensure its lasting natural beauty.

PLANT COMMUNITIES

Manatee Springs State Park has 13 plant communities, as circumscribed by the Florida Natural Areas Inventory 1988 (Figure 1). Although the overall change in elevation within the park is only a gradual nine meters from the river eastward (Department of Natural Resources 1989), the species composition varies substantially along this gradient. Observations on species dominance within each community were recorded as plant collections were made. Here, each community is described based on personal observations and the ecological literature (Figure 1).

The recently acquired Meud-Scot track, a small strip of land bordering the river south of the major portion of the park and encompassing 93 ha, was not included in the management plan's description of natural areas (Department of Natural Resources 1989). Thus coverage of communities within the rest of the park is given as a percentage of the total land area, excluding the Meud-Scot track. The tract consists predominantly of floodplain swamp with a small strip of floodplain forest and an area of xeric hammock.

Upland mixed forest. Around 13% (117 ha) of the park is upland mixed forest, also known as mesic hammock. Some of the original community has been altered due to the development of camping facilities, but it can also be found scattered in other locations, mostly intergrading with xeric hammock (Department of Natural Resources 1989). This intergradation can be gradual,

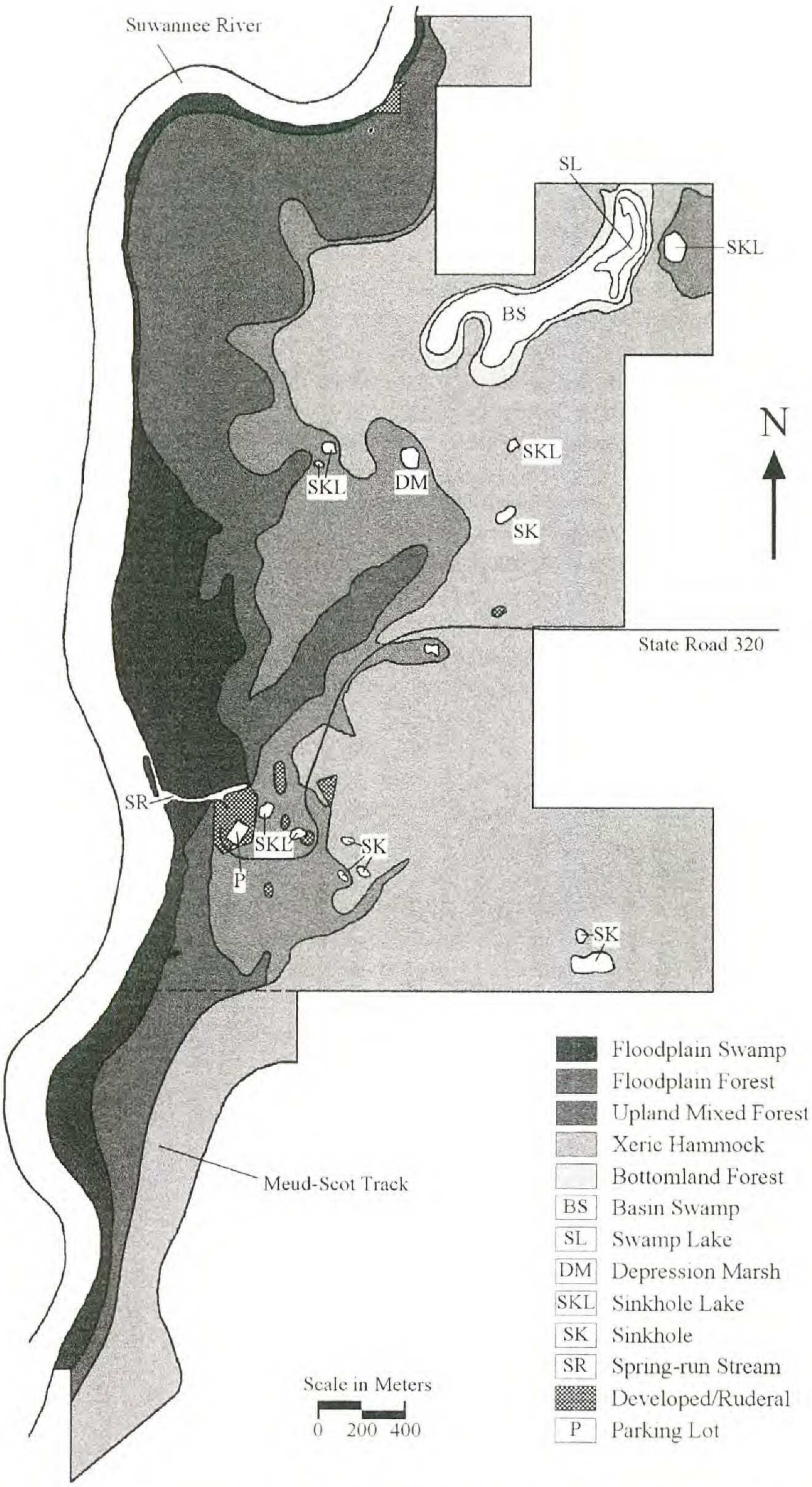

Figure 1. Plant community map of Manatee Springs State Park (adapted from Department of Natural Resources 1989).

and these two plant communities often are arbitrarily delimited (see also Platt and Schwartz 1990). Thus, it is usually impossible to separate this vegetational continuum into distinct, easily demarcated categories. What is called upland mixed forest in this park is simply one of several transition zones from moist to dry woods.

The diversity of tree species is usually high in mesic hammocks. Hardwoods such as *Magnolia grandiflora, Carya glabra, Liquidambar styraciflua, Ostrya virginiana, Ilex opaca, Quercus virginiana, Q. michauxii,* and *Persea borbonia* dominate. *Pinus taeda* and *P. glabra,* however, are also found in this community. Around the camping and picnic areas, *Sideroxylon lanuginosum* and *Tilia americana* are common. Toward the northern fence, *Diospyros virginiana* is frequent. *Symplocos tinctoria* is found more abundantly in the eastern part of the park and near Graveyard Pond, a sinkhole lake found in the northeast corner of the park. In these patches of upland mixed forest, other commonly encountered trees and shrubs are *Celtis laevigata, Juniperus virginiana* var. *silicicola, Osmanthus americana, Prunus caroliniana, P. serotina, Quercus nigra, Sabal palmetto, Vaccinium arboreum,* and *Callicarpa americana.* Various species of *Smilax* are common vines. Typically, the herb layer is not well developed in upland mixed forest, but many grasses and sedges as well as other herbs such as *Galium tinctorium, Amsonia tabernaemontana,* and *Polygala grandiflora* are common.

The mesic conditions prevailing in upland mixed forests are normally attributed to the higher clay and organic content in the soil, deeper leaf mulch, and dense canopy that traps humidity. The higher moisture content in these areas makes them less likely to burn than the surrounding pine dominated communities (Florida Natural Areas Inventory 1988).

Soils in the park that support upland mixed forest are mostly Otela-Tavares complex, but there is also Jonesville-Otela-Seaboard complex underlying this community southeast of the spring (Natural Resources Conservation Service 1996).

Xeric hammock. Xeric hammock replaces upland mixed forest at higher elevations. Typically, it occupies sandy soils of ancient dune origin. The canopy can be low or multi-layered, open or closed. The presence or absence of these characteristics can often be attributed to the stage of succession. Hardwoods such as

Quercus geminata, *Q. virginiana*, and *Q. hemisphaerica* are the most abundant trees, while the herb layer is sparse (Florida Natural Areas Inventory 1988). Xeric hammock covers 57% of the park, or 533 ha (Department of Natural Resources 1989).

Manatee Springs is situated on the northwest corner of what is called the Gulf Hammock area, one of the larger regions in Florida to contain extensive hardwood forests (Myers and Ewel 1990). The management plan for the park defines the upland portions of the park as consisting of upland mixed forest, upland pine forest, sandhill, scrubby flatwoods, and xeric hammock (Department of Natural Resources 1989). However, with the exception of upland mixed forest, the rest of the upland forests are too uniform and intergrading to be divided into four categories (based upon a subjective assessment by the authors). Probably none of these categories adequately describes the actual pattern of species composition within this community. Xeric hammock is here interpreted to cover all of these upland forest categories.

There are a large number of pines, including *Pinus palustris*, *P. elliottii*, and *P. taeda*. These could indicate that the area might not always have had dominant hardwoods. Prolonged fire exclusion may have caused a succession from a pine dominated community to xeric hammock. The records of extensive longleaf pine logging early in the century would support this idea. In addition, some ecologists theorize that, historically, dominance in these forests has shifted several times between pines and hardwoods (Myers and Ewel 1990). Controlled burns are performed on this land and may serve to eventually change its characteristics (Department of Natural Resources 1989).

Another aspect that varies in xeric hammock is the presence in the park of both closed- and open-canopied forests. Areas with open canopies may have been interpreted as scrubby flatwoods, but the lack of many characteristic elements, along with the rolling topography, does not support this classification.

Dominant trees and shrubs are *Quercus virginiana*, *Serenoa repens*, *Vaccinium arboreum*, *Quercus geminata*, *Carya glabra*, *Quercus incana*, *Q. falcata*, *Q. hemisphaerica*, *Q. myrtifolia*, *Magnolia grandiflora*, *Liquidambar styraciflua*, *Persea borbonia*, *Lyonia ferruginea*, *Ilex opaca*, *Osmanthus americana*, *Ilex vomitoria*, and *Gaylussacia dumosa*. *Solidago odora* var. *chapmanii* and *Indigofera caroliniana* are characteristic herbs. Otela-Tavares

complex soils underlie this community (Natural Resources Conservation Service 1996).

Sinkhole. The karst terrain of the park is marked by numerous sinkholes of various sizes with a total area of around 6.5 ha (Department of Natural Resources 1989). The majority of these remain dry for most of the year, draining rapidly after periods of rain. However, if the lower reaches of a sinkhole are located below the water level, it remains flooded (Florida Natural Areas Inventory 1988). The majority of dry sinkholes in the park are located southeast of the spring. The surrounding community is primarily upland mixed forest.

Vegetation in sinkholes is affected by the steepness of the sides and whether or not sand and soil cover the limestone walls (Florida Natural Areas Inventory 1988). Ferns are common as well as lichens and mosses. Most of the sinkholes in the park have gradually sloping sides without much exposed limestone.

Sinkhole lake. These are sinkholes that retain water and are therefore constantly flooded (Florida Natural Areas Inventory 1988). There is only one large sinkhole lake in the park, called Graveyard Pond, which occupies about 3 ha in the northeast quadrant of the park. Several small sinkhole ponds can be found as well, which are located near the main spring (Department of Natural Resources 1989). The standing water in these sinkhole lakes and ponds allows for a proliferation of aquatic plants such as *Lemna obscura, Landoltia punctata, Wolffia brasiliensis, Wolffiella gladiata, Pistia stratiotes,* and *Salvinia minima.*

Swamp lake. Shacklefoot Pond, located in the northeast corner of the park, is a 5 ha swamp lake (Department of Natural Resources 1989). Although stumps and trees are found in the lake, it is overall an open, permanent body of water surrounded by a basin swamp.

Hydrophilic trees are found both on the fringe of the lake and occasionally emerging in the middle. These include *Taxodium distichum* and *Gleditsia aquatica.* Throughout the lake itself are many floating and emergent aquatic herbs. The most common of these are *Lemna obscura, Wolffia brasiliensis, Spirodela punctata, Wolffiella gladiata, Limnobium spongia, Ceratophyllum de-*

mersum, Utricularia foliosa, Boehmeria cylindrica, and *Salvinia minima.*

Basin swamp. There is a large basin swamp in the northeast corner of the park. This community takes up about 11 ha and surrounds Shacklefoot Pond, a large swamp lake (Department of Natural Resources 1989). This community is often flooded, so species occurring within it must be adapted to a long hydroperiod. The soils found on this site are Placid and Samsula soils, acidic peat over a dark gray sand (Natural Resources Conservation Service 1996).

The dominant tree in this basin swamp community is *Taxodium distichum.* Other common trees and shrubs are *Myrica cerifera, Cyrilla racemiflora, Cephalanthus occidentalis,* and *Salix caroliniana.* The epiphytes *Tillandsia usneoides* and *T. bartramii* are common, as is the herb *Scutellaria integrifolia.* There is a large feral hog population in the park, and hogs are especially active in this area (Department of Natural Resources 1989). The damage these hogs do to the surface of the peat is evident throughout the swamp. As a result, herbaceous plants are less frequent here than might be expected for a typical basin swamp.

Bottomland forest. A ribbon of bottomland forest covering about 7 ha surrounds the basin swamp around Shacklefoot Pond (Department of Natural Resources 1989). This is basically a simple transition zone from the constantly inundated pond to the surrounding uplands. Along the slope leading down to the pond, there is a gradual increase in the number of flood-adapted species. The appearance is similar to a floodplain forest, but with a more diverse and abundant herb layer (Florida Natural Areas Inventory 1988).

Some of the plants found in this community are *Quercus nigra, Sabal palmetto, Magnolia grandiflora, Pinus taeda, Toxicodendron radicans, Hypericum galioides,* and *Scutellaria integrifolia.*

Depression marsh. One small depression marsh exists within the park; it is located in the middle of the park and occupies 0.5 ha. The center of the marsh is flooded and the surrounding soil remains moist year round. During some parts of the year, the pond itself contains aquatic herbs, including *Brasenia shreberi.* The marsh is dominated entirely by herbaceous species such as

Eupatorium compositifolium, Xyris platylepis, Juncus marginatus, and *Cuscuta compacta,* except for the common shrub, *Cephalanthus occidentalis.*

Floodplain swamp. The entire western edge of the park is a floodplain swamp running along the Suwannee River. The swamp occupies around 158 ha or 17% of the total park area (Department of Natural Resources 1989). Much of the swamp remains inundated throughout the year. The soils found here are Chobee-Bradenton complex, Holopaw-Pineda complex, and Chobee-Gator complex, all frequently flooded soils (Natural Resources Conservation Service 1996).

By far, the dominant tree in the floodplain swamp is *Taxodium distichum,* with *Nyssa biflora* also frequent. Other common plants are *Saururus cernuus, Crinum americanum, Cephalanthus occidentalis, Samolus valerandi* subsp. *parviflorus, Proserpinaca palustris,* and *Senecio glabellus.*

Floodplain forest. Floodplain forests are transitional from floodplain swamps to upland communities and flood less frequently than swamps, typically only during peak water levels. Plants in this community are adapted to only seasonal inundation and cannot survive constant saturation of the soil (Florida Natural Areas Inventory 1988). As would be expected, the floodplain forest occupies a strip of roughly 92 ha between the swamp and the uplands of the rest of the park (Department of Natural Resources 1989). Much of the soil underlying this strip is either of the Ousley-Albany complex, Placid, or Samsula soils (Natural Resources Conservation Service 1996).

Typical trees are *Quercus laurifolia, Q. lyrata, Fraxinus caroliniana, Planera aquatica, Acer rubrum, Carpinus caroliniana, Sabal palmetto,* and *Crataegus* spp. Common shrubs include *Cornus foemina, Serenoa repens,* and *Sabal minor. Toxicodendron radicans* and *Ampelopsis arborea* are characteristic vines. Herbs include *Panicum rigidulum* and *Amsonia tabernaemontana.*

In both the floodplain swamp and floodplain forest communities in Manatee Springs, feral hogs are a constant destructive force. Although trapping is an ongoing effort for park rangers, feral hog populations are large, and evidence of foraging is widespread.

Blackwater stream. The Suwannee River, which forms the western boundary of the park, is classified as a blackwater stream by the Florida Natural Areas Inventory due to the high tannin levels in the water, which give it a characteristic tea color (Florida Natural Areas Inventory 1988). However, a more popular river classification developed by Beck (1965) ranks the Suwannee as a calcareous stream. Both categories are probably generalizations and do not adequately describe the entire river. Blackwater streams are mostly acidic, originate in swamps, and do not usually have either extensive floodplains or large amounts of submerged aquatics (Florida Natural Areas Inventory 1988). Calcareous streams are fed mostly by springs and are generally alkaline with heavy aquatic plant growth. The Suwannee originates in swamps, but in Levy County, it is fed by several large springs such as Manatee, that influence the river locally with calcareous water (Myers and Ewel 1990). With the exception of the entrance to the spring run, emergent plant growth is sparse along the edge of the river. However, both *Senecio glabellus* and the exotic pest *Alternanthera philoxeroides* are common.

Spring-run stream. The 381 m stream that carries water from Manatee Spring to the Suwannee River is described as a spring-run stream (Department of Natural Resources 1989). This alkaline stream is an excellent habitat for many aquatic herbs, both emergent and submerged. The water is clear, allowing light to filter to the bottom of the limestone streambed and promoting the growth of *Vallisneria americana*. Periods of heavy flooding such as during the winter of 1998 can cause tea-colored water from the Suwannee to back up into the spring-run stream (Florida Natural Areas Inventory 1988). The 1998 influx resulted in a partial dieback of submerged aquatics, but a drier than typical spring helped return the stream to its previous state.

In the streambed itself, *Vallisneria americana* is the dominant submerged plant. Along the fringe, however, there are numerous species of both submerged and emergent plants including *Cabomba caroliniana*, *Sagittaria kurziana*, *Nuphar advena*, *Echinodorus berteroi*, and *Pontederia cordata*. Also present is the exotic pest *Hydrilla verticillata*.

Ruderal and developed areas. Due to the popularity of Manatee Springs as a swimming hole and camping area, devel-

opment has occurred. The most frequented area is the spring itself. A parking lot, bathhouse, and picnic area are present to accommodate visitors, as well as a concrete ramp around part of the spring and a small beach area for swimmers to enter the spring with as little damage to the remaining edge as possible. A boardwalk extends along the spring-run stream to a boat dock on the Suwannee River. There are also two camping areas near the spring and two residences within the park. The development around the spring takes up about 4 ha (Department of Natural Resources 1989). In addition to disturbances such as roads and trails, there is a large borrow pit located southeast of the spring.

Disturbed zones are usually dominated by early successional weeds such as *Eupatorium compositifolium*, *Paronychia americana*, *Gnaphalium purpureum*, *G. obtusifolium*, and *Ambrosia artemisiifolia*. The roadside is especially diverse in the fall, with numerous composites such as *Coreopsis leavenworthii*, *Liatris elegans*, *L. graminifolia*, *Pityopsis graminifolia*, and *Solidago odora* var. *chapmanii*. Other notable roadside plants are *Dicerandra densiflora*, *Trichostema dichotomum*, and *Arenaria serpyllifolia*. The borrow pit area contains a large population of the exotic *Leonitis nepetefolia*, as well as *Eupatorium compositifolium* and *Rhynchosia michauxii*.

MATERIALS AND METHODS

Plant collections were made from May 1996 to November 1998. Most of the park could be covered by walking the trail system, with occasional transects into the woods. Exceptions to this were the spring-run stream, riverbank, and floodplain swamp/floodplain forest boundary. For the spring-run stream and riverbank, a canoe was used to survey the edge, and a mask and snorkel was necessary to find several aquatics growing in the spring. Foot trips were made that generally followed the floodplain swamp edge and the boundary of the park to assess the species richness in the disturbed vegetation along the fence. Soil maps and previous plant community maps (Department of Natural Resources 1989) were used to identify areas of interest.

The plants were initially identified using Clewell (1985), Wunderlin (1982), and Godfrey and Wooten (1979, 1981). However, after Wunderlin (1998) was published, this guide was used for

most of the remaining identifications. Vouchers were deposited in the University of Florida Herbarium (FLAS).

RESULTS

The authors found a total of 360 vascular plant species in the park, representing 253 genera and 100 families. The largest families were Poaceae (41 spp.), Asteraceae (36 spp.), and Fabaceae (27 spp.). The largest genera were *Quercus* (13 spp.), *Dichanthelium* (8 spp.), *Cyperus* (6 spp.), *Rynchospora* (6 spp.), *Smilax* (5 spp.), *Ilex* (5 spp.), and *Vaccinium* (5 spp.). The complete annotated list of the vascular plants of the park is found in the appendix.

DISCUSSION

There were several species of special concern in the park. These were broken down into the following categories: taxonomic problems, species at or near their geographical limits, exotic and endemic species, and rare or endangered species.

There was an interesting *Yucca* population in the park that did not seem to fit completely the description for *Yucca filamentosa*. This entity was a robust plant with stiff leaves up to a meter in length. It bloomed in late July, slightly later than the more common form of this species. This plant may represent a taxonomic entity distinct from the widely distributed form, frequently treated as *Y. flaccida*. Further study is needed to determine the exact pattern of variation within the *Y. filamentosa* complex.

Several species were at the limits of their geographical ranges. An on-line atlas was used to determine species ranges within Florida (Wunderlin et al. 1997). These plants were divided into several categories for this list (i.e., species at their limit and species near their limit for both northern and southern limits). A species at its southern limit does not occur in any counties south of Levy (and the reverse for a species at its northern limit). A species near its southern limit only occurs one or two counties further south (and the reverse for a species near its northern limit).

Ten species were at their southern limit: *Pinus glabra, Sium suave, Betula nigra, Quercus lyrata, Dichanthelium oligosanthes, Saccharum alopecuroides, Crataegus aestivalis, C. michauxii, Galium tinctorium,* and *Planera aquatica*. Nineteen species were

Table 1. State-listed endangered (E), threatened (T), and commercially exploited (CE) vascular plants occurring in Manatee Springs State Park, following Coile (1993).

Species	Status
Asplenium platyneuron	T
Epidendrum conopseum	T
Ilex ambigua	T
Ilex decidua	T
Ilex opaca	CE
Lobelia cardinalis	T
Matelea floridana	E
Osmunda regalis	CE
Sabal minor	T
Tillandsia bartramii	T
Woodwardia areolata	T
Zamia integrifolia	CE

near their southern limit: *Pinus taeda, Justicia ovata, Sagittaria kurziana, Asimina longifolia, Ostrya virginiana, Triadenum walteri, Cuscuta compacta, Cornus asperifolia, Carex dasycarpa, Cyperus plukenetti, Baptisia alba, Desmodium canescens, Lespedeza stuevei, Quercus michauxii, Carya tomentosa, Fraxinus americana, Halesia carolina, Ulmus alata,* and *U. crassifolia.*

Only a few species were at or near their northern limits for Florida. These were *Tillandsia recurvata* and *Senna ligustrina* (at northern limit), as well as *Zamia integrifolia, Pistia stratiotes, Utricularia foliosa, Cenchrus gracillimus, Phlebodium aureum,* and *Ulmus crassifolia* (near northern limit).

Non-native, or exotic, species following Wunderlin (1998) found in the park were *Alternanthera philoxeroides, Chenopodium ambrosioides, Cyclospermum leptophyllum, Pistia stratiotes, Arenaria serpyllifolia, Cyperus lanceolatus, Crotalaria lanceolata, Desmodium canescens, Hydrilla verticillata, Sisyrinchium rosulatum, Hyptis mutabilis, Leonitis nepetefolia, Broussonetia papyrifera, Eremochloa ophiuroides, Lolium perenne, Paspalum notatum, Poa annua, Secale cereale, Sporobolus indicus, Richardia brasiliensis,* and *Xyris jupicai.* There were nine Florida endemics or near endemics (see Muller et al. 1989) growing in the park: *Aristida patula, Coreopsis leavenworthii, Dicerandra densiflora, Matelea floridana, Palafoxia integrifolia, Pycnanthemum floridanum, Rhynchosia michauxii, Solidago odora* var. *chapmanii,* and *Vicia floridana.*

State-listed endangered, threatened, and commercially exploited plants are summarized in Table 1. No federally listed endangered species were found in the park.

The flora of Manatee Springs State Park is a reasonable representation of plants that would be expected in natural communities bordering the Suwannee River in Florida. Exotic plants, while common, are still much less prevalent inside the park than in the surrounding areas, proving the benefits of good land management. It is hoped that continued protection will maintain a diverse and historically representative flora of the region.

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APPENDIX

ANNOTATED LIST OF VASCULAR PLANTS

The species names in this list follow Wunderlin (1998), fern and gymnosperm family circumscriptions follow *Flora of North America North of Mexico* (Flora of North America Editorial Committee 1993), and angiosperm family circumscriptions follow the Angiosperm Phylogeny Group (1998), except when stated otherwise.

The abbreviations for plant communities are as follows: UMF – Upland Mixed Forest; XH – Xeric Hammock; SH – Sinkhole; SKL – Sinkhole Lake; SL – Swamp Lake; BS – Basin Swamp; BF – Bottomland Forest; DM – Depression Marsh; FS – Floodplain Swamp; FF – Floodplain Forest; BLS – Blackwater Stream; SR – Spring-run Stream; RU – Ruderal/Developed. Some

additional notes may also be given regarding specific locations. For abundance, the following abbreviations were used, based on the collectors' observations of the plant in each community: R – rare (1–4 observations); I – infrequent (5–9 observations); O – occasional (10–24 observations); F – frequent (25 or more observations); A – abundant (denotes a plant that is dominant in its habitat and may influence the overall appearance of the community). It should be noted that, in many cases, abundance is seasonal.

A previous unpublished list of plants from the park was made by David Hall (1985), and we have included 31 of these species in the main list that were not found by us. Eight of these are exotic weeds. These entries are denoted with Hall NV (non-vouchered) in place of a collection number. Also, species that were new records for the county (according to Wunderlin et al. 1997) are indicated with the word "new" at the end of the entry, and exotic species are noted with an asterisk. Collection numbers are those of the first author.

FILICOPSIDA

ASPLENIACEAE

Asplenium platyneuron (L.) Britton, Sterns & Poggenb. – BF; R; *230.*

BLECHNACEAE

Woodwardia areolata (L.) Moore – BS; O; *22.*

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn var. *pseudocaudatum* (Clute) A. Heller – UMF, XH & RU; F; *377.*

OSMUNDACEAE

Osmunda regalis L. – SH; I; *7.*

POLYPODIACEAE

Phlebodium aureum L. – BF; R; *284.*

Pleopeltis polypodioides (L.) E. G. Andrews & Windham var. *michauxiana* (Weath.) E. G. Andrews & Windham – UMF, XH, SH, BF, FF & RU; F; *409.*

SALVINIACEAE

Salvinia minima Baker – SL & SKL; F; *403.*

THELYPTERIDACEAE

Thelypteris kunthii (Desv.) C. V. Morton – BS; O; *342.*

CYCADOPSIDA

ZAMIACEAE

Zamia integrifolia L. f. *in* Aiton – XH & UMF; O; 229. [The correct name of this taxon is in doubt. When *Z. integrifolia* was described, "*Z. pumila.* Sp. Pl. 1659. (exclusis synonymis)" was included in its synonomy, causing some authors to believe that *Z. integrifolia* is a superfluous name. However, Dan Nicolson (US), Richard Brummitt (K), and Kanchi Gandhi (GH; pers. comm.) have suggested that by this statement ("exclusis synonymis") Linnaeus f. automatically excluded all the type elements that would otherwise cause superfluity; these authors are of the opinion that this exclusion made the name *Z. integrifolia* legitimate and available for use. They also noted that *Z. pumila* was lectotypified by one of the four elements cited within its protologue, and this LT element was excluded from *Z. integrifolia.* Some authorities, who treat *Z. integrifolia* as superfluous, use the name *Z. floridana* A. DC. for these Florida plants (Daniel Ward, pers. comm.); those considering them conspecific with similar plants occurring in the Greater Antilles use the name *Z. pumila.*]

CONIFEROPSIDA

CUPRESSACEAE

Juniperus virginiana L. var. *silicicola* (Small) Bailey – UMF; O; *443.* (Adams 1986)
Taxodium distichum (L.) Rich. – SL, BS & FS; A; *121.*

PINACEAE

Pinus elliottii Engelm. – UMF & XH; F; *537.*
P. glabra Walter – BF & UMF; O; *608.*
P. palustris Mill. – XH; O; *583.*
P. taeda L. – UMF, BF & XH; F; *529.*

ANGIOSPERMAE

ACANTHACEAE

Justicia ovata (Walter) Lindau – FF; O; *401.*
Ruellia caroliniensis (Walter *ex* J. F. Gmel.) Steud. – UMF & XH; O; *21.*

ACERACEAE (see SAPINDACEAE)

ADOXACEAE

Viburnum obovatum Walter – FF; F & UMF; I; *159.*

AGAVACEAE

Yucca aloifolia L. – UMF; R, only a few plants present at corner of parking lot, possibly planted; *457.*

Y. filamentosa L. – XH; O; *76, 398.*

ALISMATACEAE

Echinodorus berteroi (Spreng.) Fassett – SR; O; *103.*
E. tenellus (Mart.) Buchenau – SL; O; *572,* new.
Sagittaria kurziana Glück – SR; F; *451.*

ALTINGIACEAE

Liquidambar styraciflua L. – UMF & XH; F; *97.*

AMARANTHACEAE (incl. CHENOPODIACEAE)

**Alternanthera philoxeroides* (Mart.) Griseb. – FS; I; *109,* new.
**Chenopodium ambrosioides* L. – RU; I; *560.*
Froelichia floridana (Nutt.) Moq. – RU; O; *155, 478.*

AMARYLLIDACEAE

Crinum americanum L. – FS; F; *611.*

ANACARDIACEAE

Rhus copallina L. – XH & UMF; O; *397.*
Toxicodendron radicans (L.) Kuntze – FF, FS & BF; O; *255.*

ANNONACEAE

Asimina longifolia Kral var. *longifolia* – XH; R; *313.* (= *A. angustifolia* Raf.; see Kral 1997)
A. parviflora (Michx.) Dunal – XH; R; *591.*
A. pygmaea (W. Bartram) Dunal – XH; *Hall NV.*

APIACEAE (incl. ARALIACEAE; Judd et al. 1994, 1999; Thorne 1983)

Aralia spinosa L. – XH; I; *290, 399.*
Centella asiatica (L.) Urb. – BS; O; *578.*
**Cyclospermum leptophyllum* (Pers.) Sprague *ex* Britton & P. Wilson – BS; F; *167, 548.*
Hydrocotyle verticillata Thunb. – BS; F; *34.*
Ptilimnium capillaceum (Michx.) Raf. – BS; O; *32, 345.*
Sanicula canadensis L. – XH; O; *61, 77.*
Sium suave Walter – SR; I; *489.*
Spermolepis divaricata (Walter) Raf. – RU; O; *309.*

APOCYNACEAE (incl. ASCLEPIADACEAE)

Amsonia tabernaemontana Walter – FF; F; *3, 173.*
Apocynum cannabinum L. – RU; I; *586.*
Asclepias humistrata Walter – XH; I; *563.*
A. perennis Walter – FS; I; *70, 378.*
A. tuberosa L. – UMF & XH; O; *43, 300.*

Matelea floridana (Vail) Woodson – XH; I; *554.*

AQUIFOLIACEAE

Ilex ambigua (Michx.) Torr. var. *ambigua* – XH & UMF; F; *72, 98, 151, 279, 321, 445, 458, 550.*
I. coriacea (Pursh) Chapm. – XH; O; *533.*
I. decidua Walter – FF & UMF; O; *460, 484.*
I. opaca Aiton var. *opaca* – UMF; F & XH; O; *95.*
I. vomitoria Aiton – XH; O; *296, 389.*

ARACEAE (incl. LEMNACEAE)

Landoltia punctata (G. Mey.) D. H. Les & D. J. Crawford – SKL & SL; A; *404*, new. (Les and Crawford 1999)
Lemna obscura (Austin) Daubs – SKL & SL; A; *405.*
**Pistia stratiotes* L. – SKL; O; *461.* [Considered introduced by Wunderlin (1998) but not by the authors, as the species has been reported by several early botanical explorers (e.g., Bartram 1791).]
Wolffia brasiliensis Wedd. – SKL & SL; F; *616.*
Wolffiella gladiata (Hegelm.) Hegelm. – SKL & SL; F; *617*, new.

ARALIACEAE (see APIACEAE)

ARECACEAE

Sabal minor (Jacq.) Pers. – FF, UMF & BF; I; *584.*
S. palmetto (Walter) Lodd. *ex* Schult. & Schult. f. – FF, UMF & BF; F; *609.*
Serenoa repens (W. Bartram) Small – FF, UMF & XH; F; *388.*

ARISTOLOCHIACEAE

Aristolochia serpentaria L. – FF; R; *487.*

ASCLEPIADACEAE (see APOCYNACEAE)

ASTERACEAE

Acmella oppositifolia (Lam.) R. K. Jansen var. *repens* (Walter) R. K. Jansen – FF; O, on edge of spring; *418.*
Ageratina jucunda (Greene) Clewell & Wooten – UMF & XH; I; *122, 507.*
Ambrosia artemisiifolia L. – RU; F; *152.*
Aster dumosus L. – RU; I; *498.*
Baccharis halimifolia L. – UMF; O, found only in Meud-Scot track; *499.*
Balduina angustifolia (Pursh) B. L. Rob. – RU; O; *129, 437.*
Bidens alba (L.) DC. var. *radiata* (Sch. Bip.) Ballard *ex* Melchert – RU; I; *465.*
Chrysopsis gossypina (Michx.) Elliott subsp. *gossypina* – RU; O; *130.*
Cirsium horridulum Michx. – UMF; I; *168.*
Conoclinium coelestinum (L.) DC. – FF; O, on edge of spring; *117, 406.*

Conyza canadensis (L.) Cronquist var. *pusilla* (Nutt.) Cronquist – RU; O; *87, 133.*
Coreopsis leavenworthii Torr. & A. Gray – RU; F; *68, 142, 374.*
Elaphantopus nudatus A. Gray – UMF; F; *115, 139, 370.*
Erechtites hieracifolia (L.) Raf. *ex* DC. – BS; O; *571.*
Erigeron quercifolius Lam. – RU; O; *10, 308.*
E. strigosus Muhl. *ex* Willd. – RU; F; *41, 131,* new.
Eupatorium album L. – XH; F; *438.*
E. compositifolium Walter – DM & RU; F; *125, 144.*
E. rotundifolium L. – UMF; I; *153.*
Gnaphalium pensylvanicum Willd. – RU; O; *231.*
G. purpureum L. – RU; O; *239, 306.*
Heterotheca subaxillaris (Lam.) Britton & Rusby – RU; I; *581.*
Hieracium gronovii L. – XH & RU; O; *475.*
Krigia virginica (L.) Willd. – XH & RU; O; *242.*
Lactuca graminifolia Michx. – RU; O; *88, 281.*
Liatris elegans (Walter) Michx. – RU; F; *124,* new.
L. graminifolia (Walter) Willd. – RU; F; *123.*
L. tenuifolia Nutt. var. *tenuifolia* – RU; O; *128.*
Melanthera nivea (L.) Small – FF; R; *488.*
Mikania scandens (L.) Willd. – FS; I, on river island opposite spring run entrance; *112, 113.*
Palafoxia integrifolia (Nutt.) Torr. & A. Gray – RU; O; *136.*
Pityopsis graminifolia (Michx.) Nutt. – RU; A; *137.*
Pyrrhopappus carolinianus (Walter) DC. – XH & RU; I; *57, 244, 301.*
Senecio glabellus Poir. – FS; F; *29, 67, 116.*
Solidago odora Aiton var. *chapmanii* (Torr. & A. Gray) Cronquist – XH & RU; F; *145, 473.*
Vernonia angustifolia Michx. – XH; O; *78.*

BETULACEAE

Betula nigra L. – FF; O; *410.*
Carpinus caroliniana Walter subsp. *caroliniana* – FF & UMF; F; *93.* (Furlow 1987)
Ostrya virginiana (Mill.) K. Koch – UMF; F; *11.*

BIGNONIACEAE

Bignonia capreolata L. – UMF & XH; O; *232.*
Campsis radicans (L.) Seem. *ex* Bureau – FF & UMF; F; *612.*

BRASSICACEAE

Lepidium virginicum L. – RU; R; *24.*
**Rorippa nasturtium-aquaticum* (L.) Hayek – SR; *Hall NV.*

BROMELIACEAE

Tillandsia bartramii Elliott – BS & BF; F; *165.*
T. recurvata (L.) L. – UMF, FS, FF, BF, BS & XH; F; *610.*

T. usneoides (L.) L. – XH, UMF, BF, FF & BS; A; *154.*

BURMANNIACEAE

Apteria aphylla (Nutt.) Barnhart *ex* Small – BS; *Hall NV.*
Burmannia biflora L. – FS; I; *45, 495,* new.

CABOMBACEAE (see NYMPHAEACEAE)

CACTACEAE

Opuntia humifusa (Raf.) Raf. var. *humifusa* – RU; I; *5.* (Benson 1982)

CAMPANULACEAE

Lobelia cardinalis L. – FS; O, located along river; *101, 102.*
Triodanis perfoliata (L.) Nieuwl. – RU; I; *542.*

CAPRIFOLIACEAE *pro parte*, (i.e., *Viburnum*—see ADOXACEAE)

CARYOPHYLLACEAE

**Arenaria serpyllifolia* L. – RU; I; *243a, 546.*
Drymaria cordata (L.) Willd. *ex* Schult. – RU; O; *241, 568,* new.
Paronychia americana (Nutt.) Fenzl *ex* Walp. – XH & RU; O; *71.*
P. baldwinii (Torr. & A. Gray) Fenzl *ex* Walp. – XH & RU; I; *576.*
Stipulicida setacea Michx. var. *setacea* – RU; I; *602.*

CELTIDACEAE

Celtis laevigata Willd. – UMF; F; *614.*

CERATOPHYLLACEAE

Ceratophyllum demersum L. – SL; I; *569.*

CHENOPODIACEAE (see AMARANTHACEAE)

CHRYSOBALANACEAE

Licania michauxii Prance – XH; O; *333.*

CISTACEAE

Helianthemum carolinianum (Walter) Michx. – RU; I; *247.*
Lechea minor L. – RU; O; *477,* new.

CLUSIACEAE

Hypericum crux-andreae (L.) Crantz – RU; I; *472,* new.
H. galioides Lam. – BF; F; *30, 44, 307, 575.*
H. hypericoides (L.) Crantz. – UMF & RU; O; *89.*

H. mutilum L. – BF; O; *27, 346.*
Triadenum walteri (J. F. Gmel.) Gleason – BS & BF; I; *574.*

COMMELINACEAE

Commelina erecta L. – XH; O; *51.*

CONVOLVULACEAE

Cuscuta compacta Juss. – DM; O; *497,* new.
Dichondra carolinensis Michx. – XH & RU; O; *250.*
Stylisma patens (Desr.) Myint – UMF; R; *48.*

CORNACEAE (incl. NYSSACEAE)

Cornus asperifolia Michx. – FF; O; *74.*
C. foemina Mill. – FF; O; *253, 452.*
Nyssa biflora Walter – FS; F; *459.* (Burkhalter 1992)
N. sylvatica Marshall var. *sylvatica* – XH; I, but locally frequent at one site on east side of park; *485,* new.

CYPERACEAE

Bulbostylis ciliatifolia (Elliott) Fernald – XH & RU; I; *319.*
Carex dasycarpa Muhl. – XH; O; *264.*
C. granularis Muhl. *ex* Schkuhr *in* Willd. – FF & RU; O, on edge of spring run; *422.*
C. longii Mack. – RU; I; *36, 268, 347.*
Cyperus croceus Vahl – RU; *Hall NV.*
C. distinctus Steud. – FF & RU; O, on edge of spring run; *423.*
C. filiculmis Vahl – XH & RU; O; *320.*
C. flavescens L. – FS, DM & BS; *Hall NV.*
**C. lanceolatus* Poir. *in* Lam. – BS; I; *353,* new.
C. plukenetti Fernald – XH; O; *84,* new.
C. polystachyos Rottb. – FF & DM; *Hall NV.*
C. retrorsus Chapm. – UMF, XH & RU; F; *40, 149, 150.*
**C. rotundus* L. – RU; *Hall NV.*
C. strigosus L. – FF & RU; O, on edge of spring run; *421, 424.*
C. tetragonus Elliott – FF & UMF; *Hall NV.*
Eleocharis baldwinii (Torr.) Chapm. – DM; O; *331.*
E. montevidensis Kunth – XH; O; *341.*
Kyllinga odorata Vahl – BS & DM; *Hall NV.*
Rynchospora colorata (L.) H. Pfeiff. – FF & RU; F; *17.*
R. corniculata (Lam.) A. Gray – FS; O; *75, 119.*
R. inundata (Oakes) Fernald – FS & RU; I; *466.*
R. megalocarpa A. Gray – XH & RU; F; *92, 316, 334.*
R. microcarpa Baldwin *ex* A. Gray – DM & BS; O; *335.*
R. plumosa Elliott – BS; I; *60.*
Scleria reticularis Michx. – DM; F; *337.*
S. triglomerata Michx. – UMF; O; *265, 395.*

CYRILLACEAE

Cyrilla racemiflora L. – FF; I; *14.*

EBENACEAE

Diospyros virginiana L. – UMF; F; *430, 462.*

ERICACEAE

Gaylussacia dumosa (Andrews) Torr. & A. Gray – XH; O; *613.*
Lyonia ferruginea (Walter) Nutt. – XH; F; *382, 468.*
Vaccinium arboreum Marshall – UMF, F & XH; O; *2, 6, 8.*
V. darrowii Camp – XH; I; *588.*
V. elliottii Chapm. – FF & UMF; F; *1, 164, 592.* (Luteyn et al. 1996)
V. myrsinites Lam. – XH; I; *322, 536.*
V. stamineum L. – UMF; F; *9, 446.*

ERIOCAULACEAE

Lachnocaulon anceps (Walter) Morong – DM; A; *328.*

ESCALLONIACEAE (see ITEACEAE)

EUPHORBIACEAE

Acalypha gracilens A. Gray – UMF; O; *371.*
Chamaesyce maculata (L.) Small – XH & RU; I; *579.*
C. prostrata (Aiton) Small – RU; *Hall NV.*
Cnidoscolus stimulosus (Michx.) Engelm. & A. Gray – XH & RU; F; *236.*
Croton glandulosus L. – RU; I; *135.*
C. michauxii G. L. Webster – XH & RU; O; *80, 373, 435.*
Phyllanthus caroliniensis Walter – FS; I; *553.*
**P. urinaria* L. – RU; *Hall NV.*
Stillingia sylvatica Garden *ex* L. – XH; F; *81, 311.*

FABACEAE

Amorpha fruticosa L. – XH; I; *434.*
A. herbacea Walter var. *herbacea* – XH; O; *246,* new.
Baptisia alba (L.) Vent. – UMF; O; *4, 166.*
B. lecontii Torr. & A. Gray – XH; I; *302.*
Centrosema virginianum (L.) Benth. – XH & RU; O; *49, 305.*
Chamaecrista fasciculata (Michx.) Greene – RU; O; *132.*
Clitoria mariana L. – RU; I; *304.*
**Crotalaria lanceolata* E. Meyer – RU; O; *471.*
C. rotundifolia Walter *ex* J. F. Gmel. – RU; O; *50, 237.*
**Desmodium canescens* (L.) DC. – RU; O; *440,* new.
D. paniculatum (L.) DC. – XH; *Hall NV.*
D. triflorum (L.) DC. – RU; O; *141.*
Erythrina herbacea L. – UMF & RU; I; *16.*
Galactia volubilis (L.) Britton – UMF, XH & RU; O; *69, 90, 372, 429.*

Gleditsia aquatica Marshall – SL; I; *275, 355.*
Indigofera caroliniana Mill. – XH; F; *47.*
Lespedeza hirta (L.) Hornem. – RU; I; *143.*
L. stuevei Nutt. – RU; I; *469,* new.
Medicago lupulina L. – RU; I; *544.*
Mimosa quadrivalvis L. var. *angustata* (Torr. & A. Gray) Barneby – XH; O; *62, 314.*
Rhynchosia difformis (Elliott) DC. – RU; O; *476.*
R. michauxii Vail – RU; O; *436, 607.*
Senna ligustrina (L.) H. S. Irwin & Barneby – UMF; I; *412.*
S. marilandica (L.) Link – FF; F; *431.*
S. obtusifolia (L.) H. S. Irwin & Barneby – RU; O; *433.*
Tephrosia chrysophylla Pursh – RU; I; *601.*
T. florida (F. Dietr.) C. E. Wood – RU; I; *303, 376.*
**Trifolium repens* L. – RU; *Hall NV.*
Vicia floridana S. Watson – BS; O; *26, 257.*

FAGACEAE

Quercus austrina Small – UMF; O; *384,* new. (Nixon and Muller 1997)
Q. chapmanii Sarg. – XH; I; *599.*
Q. falcata Michx. – XH; O; *277, 295, 442,* new.
Q. geminata Small – XH; A; *298, 386, 387.*
Q. hemisphaerica W. Bartram – UMF & XH; F; *100, 276.* (Muller 1970)
Q. incana W. Bartram – XH; *Hall NV.*
Q. laurifolia Michx. – FF; O; *414.* (Muller 1970)
Q. lyrata Walter – FF; O; *493, 603.*
Q. margaretta Ashe *ex* Small – XH; I; *447.*
Q. michauxii Nutt. – UMF; O; *500.*
Q. myrtifolia Willd. – XH; O; *444, 527, 531.*
Q. nigra L. – UMF & BF; O; *385.*
Q. pumila Walter – XH; O; *526.*
Q. virginiana Mill. – XH & UMF; F; *673.*

GELSEMIACEAE

Gelsemium sempervirens (L.) W. T. Aiton – FF & UMF; O; *251.*

GENTIANACEAE

Bartonia paniculata (Michx.) Muhl. – BS; R; *496,* new.
Sabatia calycina (Lam.) A. Heller – BS & FS; O; *28, 66, 344.*

HALORAGACEAE

Proserpinaca palustris L. – FS; O; *63.*

HAMAMELIDACEAE (see ALTINGIACEAE)

HIPPOCASTANACEAE (see SAPINDACEAE)

HYDROCHARITACEAE

**Hydrilla verticillata* (L. f.) Royle – SR; I; *407.*
Limnobium spongia (Bosc) Steud. – SL; I; *567,* new.
Vallisneria americana Michx. – SR; A; *419.*

HYPOXIDACEAE

Hypoxis curtisii Rose – FS; F; *65, 163.*

IRIDACEAE

Sisyrinchium angustifolium Mill. – RU; I; *235.*
S. nashii E. P. Bicknell – RU; I; *541.*
**S. rosulatum* E. P. Bicknell – RU; I; *310.*

ITEACEAE

Itea virginica L. – FS; *Hall NV.*

JUGLANDACEAE

Carya glabra (Mill.) Sweet – UMF & XH; F; *258, 379.*
C. tomentosa (Poir. *in* Lam.) Nutt. – UMF & XH; O; *332.* (Rehder 1945)

JUNCACEAE

Juncus dichotomus Elliott – FF & RU; O, on edge of spring run; *420.*
J. marginatus Rostk. – DM; O; *39, 336, 564.*

LAMIACEAE

Callicarpa americana L. – UMF; O; *59.*
Dicerandra densiflora Benth. – RU; O; *126.*
**Hyptis mutabilis* (Rich.) Briq. – RU; O; *671.*
**Leonitis nepetefolia* (L.) R. Br. *in* W. T. Aiton – RU; F; *312,* new.
Micromeria brownei (Sw.) Benth. – RU; O, in lawns around spring; *19, 400.*
Monarda punctata L. – RU; I; *566.*
Pycnanthemum floridanum E. Grant & Epling – RU; I; *582.*
Salvia lyrata L. – RU; I; *282.*
Scutellaria integrifolia L. – BS; F; *25,* new.
Teucrium canadense L. – BS & BF; O; *327.*
Trichostema dichotomum L. – RU; O; *127.*

LAURACEAE

Persea borbonia (L.) Spreng. – UMF & XH; F; *413, 449.*
P. palustris (Raf.) Sarg. – BS; O; *585.*

LEMNACEAE (see ARACEAE)

LENTIBULARIACEAE

Utricularia foliosa L. – SL; O; *570.*

LOGANIACEAE (also see GELSEMIACEAE)

Mitreola petiolata (J. F. Gmel.) Torr. & A. Gray – FS; F; *64, 118.*

MAGNOLIACEAE

Magnolia grandiflora L. – UMF, BF & XH; O; *99.*

MALVACEAE (incl. TILIACEAE)

Sida rhombifolia L. – RU & XH; O; *561.*
Tilia americana L. var. *caroliniana* (Mill.) Castigl. – UMF; O; *94.*

MELASTOMATACEAE

Rhexia mariana L. – UMF & XH; O; *46, 325.*

MORACEAE

**Broussonetia papyrifera* (L.) Vent. – XH; I; *598.*

MYRICACEAE

Myrica cerifera L. – BS, FF, BF & UMF; F; *96, 294, 297, 299, 573.*

NYMPHAEACEAE (incl. CABOMBACEAE)

Brasenia shreberi J. F. Gmel. – DM; F; *330.*
Cabomba caroliniana A. Gray – SR; A; *111.*
Nuphar advena (Aiton) W. T. Aiton – BLS; O; *615.* (Wiersema and Hellquist 1994)

NYSSACEAE (see CORNACEAE)

OLEACEAE

Fraxinus americana L. – BS; *447a,* new.
F. caroliniana Mill. – FS & FF; O; *110, 354.*
Osmanthus americanus (L.) Benth. & Hook. f. *ex* A. Gray – UMF & XH; O; *273.*

ONAGRACEAE

Gaura angustifolia Michx. – UMF & RU; I; *86.*
Ludwigia repens J. R. Forst. – FS; R; *467.*
Oenothera laciniata Hill – RU; I; *559.*

ORCHIDACEAE

Epidendrum conopseum R. Br. – XH; I; *508.*

OXALIDACEAE

Oxalis corniculata L. – RU; I; *238.*

PASSIFLORACEAE

Passiflora incarnata L. – RU; R; *315.*
P. lutea L. – XH; I; *558.*

PHYTOLACCACEAE

Phytolacca americana L. var. *rigida* (Small) Caulkins & Wyatt – RU; I; *324.* (Caulkins and Wyatt 1990)

PLANTAGINACEAE

**Plantago major* L. – RU; *Hall NV.*
P. virginica L. – RU; O; *547.*

POACEAE

Andropogon glomeratus (Walter) Britton, Sterns & Poggenb. var. *pumilus* Vasey – XH; O; *535.* (Campbell 1983)
A. ternarius Michx. – XH; O; *502.*
A. virginicus L. var. *decipiens* C. S. Campb. – XH; O; *157,* new. (Campbell 1983)
A. virginicus L. var. *virginicus* – XH; F; *503, 505.* (Campbell 1983)
Aristida patula Chapm. *ex* Nash – RU; I; *482.*
Axonopus affinis Chase – BF; O; *85.*
A. furcatus (Flüeggé) Hitchc. – BF; O; *348.*
Cenchrus gracillimus Nash – RU; O; *147, 480.*
C. incertus M. A. Curtis – RU; F; *494.*
Chasmanthium sessiliflorum (Poir.) Yates – UMF & RU; F; *38, 56, 82, 339, 349, 351.*
**Cynodon dactylon* (L.) Pers. – RU; *Hall NV.*
Dichanthelium aciculare (Desv. *ex* Poir.) Gould & C. A. Clark – XH; O; *391.*
D. acuminatum (Sw.) Gould & C. A. Clark var. *acuminatum* – UMF & FF; O; *37, 263.*
D. commutatum (Schult.) Gould – UMF & FF; F; *35, 283, 287, 352.*
D. dichotomum (L.) Gould – FS; I; *464.*
D. ensifolium (Baldwin *ex* Elliott) Gould – XH & RU; O; *340.*
D. oligosanthes (Schult.) Gould – XH; O; *278.*
D. portoricense (Desv. *ex* Ham.) B. F. Hansen & Wunderlin – XH; O; *285.*
D. strigosum (Muhl.) Freckmann – BF; O; *269.*
Digitaria ciliaris (Retz.) Koeler – RU; O; *426.*
D. serotina (Walter) Michx. – RU; *Hall NV.*
Eleusine indica (L.) Gaertn. – RU; *Hall NV.*
Eragrostis elliottii S. Watson – RU; R; *146.*

E. virginica (Zucc.) Steud. – DM & RU; *Hall NV.*
**Eremochloa ophiuroides* (Munro) Hack. – FF; I; *428.*
Eustachys petraea (Sw.) Desv. – RU; O; *138, 266.*
**Lolium perenne* L. – RU; I; *540.*
Oplismenus hirtellus (L.) P. Beauv. subsp. *setarius* (Lam.) Mez *ex* Ekman – UMF & RU; F; *565.* (Scholz 1981)
Panicum anceps Michx. – DM, BS & BF; F; *83, 148, 338, 350, 393, 481.*
P. rigidulum Bosc *ex* Nees – FF; O; *120, 455, 456, 506.*
**Paspalum notatum* Flüeggé – RU & UMF; O; *54, 317.*
P. plicatulum Michx. – RU; O; *318.*
P. repens Bergius – BLS; I; *108.*
P. setaceum Michx. – RU; O; *55, 425, 439.*
Piptochaetium avenaceum (L.) Parodi – XH; I; *288, 289, 394,* new.
**Poa annua* L. – RU; F; *252.*
Saccharum alopecuroides (L.) Nutt. – XH; O; *501,* new.
S. baldwinii Spreng. – FF; F, on riverbank only; *463.*
Sacciolepis striata (L.) Nash – FS & BS; *Hall NV.*
**Secale cereale* L. – RU; R; *562.*
Setaria geniculata (Poir.) Millsp. & Chase – XH & RU; O; *156, 479.* (Godfrey and Wooten 1979)
Sorghastrum elliottii (C. Mohr) Nash – XH; O; *504.*
Sphenopholis obtusata (Michx.) Scribn. – BS; O; *539.*
**Sporobolus indicus* (L.) R. Br. var. *indicus* – RU; O; *392.*
Stenotaphrum secundatum (Walter) Kuntze – RU; O; *674.*
Vulpia elliotea (Raf.) Fernald – RU; I; *538,* new.

POLYGALACEAE

Polygala grandiflora Walter – UMF & XH; O; *23, 52, 134.*

POLYGONACEAE

Eriogonum tomentosum Michx. – XH; I; *580.*
Polygonum densiflorum Meisn. – FS, DM & BS; *Hall NV.*
P. punctatum Elliott – BS & SR; O; *42, 343, 416.*
Rumex hastatulus Baldwin – RU; I; *245.*

PONTEDERIACEAE

Pontederia cordata L. – SR; O; *104, 105.*

PRIMULACEAE

Samolus valerandi L. subsp. *parviflorus* (Raf.) Hultén – FS; F; *20, 33.*

RHAMNACEAE

Berchemia scandens (Hill) K. Koch – FS; R; *160.*
Rhamnus caroliniana Walter – UMF; *Hall NV.*

ROSACEAE

Crataegus aestivalis (Walter) Torr. & A. Gray – FF; O; *415*, new.
C. crus-galli L. – FS; *Hall NV.*
C. marshallii Eggl. – FF; *Hall NV.*
C. michauxii Pers. – XH; I; *272, 557.*
Prunus caroliniana (Mill.) Aiton – UMF; O; *12.*
P. serotina Ehrh. var. *serotina* – UMF; O; *260, 525.*
P. umbellata Elliott – XH; I; *380*, new.
Rubus argutus Link – BS; *Hall NV.*
R. cuneifolius Pursh – XH; O; *329.*
R. trivialis Michx. – XH; O; *171.*

RUBIACEAE

Cephalanthus occidentalis L. – BS, FS & DM; O; *326.*
Diodia teres Walter – RU; O; *140, 427.*
D. virginiana L. – FF; O; *114, 408, 450.*
Galium hispidulum Michx. – XH & RU; O; *249, 474.*
G. tinctorium L. – BS; I; *486.*
**Hedyotis corymbosa* (L.) Lam. – RU; *Hall NV.*
H. procumbens (Walter *ex* J. F. Gmel.) Fosberg – XH; O; *532.*
H. uniflora (L.) Lam. – UMF; *Hall NV.*
Mitchella repens L. – UMF; O; *234.*
**Richardia brasiliensis* Gomes – RU; I; *79.*

RUTACEAE

Ptelea trifoliata L. – UMF; I; *15, 73.*
Zanthoxylum clava-herculis L. – UMF; I; *551.*

SALICACEAE

Salix caroliniana Michx. – FS; O; *259, 411.*

SAPINDACEAE (incl. ACERACEAE and HIPPOCASTANACEAE)

Acer rubrum L. – FF & FS; I; *448.*
Aesculus pavia L. – XH; I; *432.*

SAPOTACEAE

Sideroxylon lanuginosum Michx. – UMF; O; *491, 530, 587.*
S. reclinatum Michx. subsp. *reclinatum* – FF; I; *490, 492.*

SAURURACEAE

Saururus cernuus L. – FS; A; *18, 106.*

SCROPHULARIACEAE

Bacopa monnieri (L.) Pennell – SR; O; *453.*
Gratiola virginiana L. – BS; I; *670*, new.

Linaria canadensis (L.) Chaz. – RU; O; *543.*
L. floridana Chapm. – RU; O; *243b.*
Mecardonia acuminata (Walter) Small – DM; *Hall NV.*
Micranthemum umbrosum (J. F. Gmel.) S. F. Blake – BS; I; *672,* new.
Veronica peregrina L. – RU; O; *240, 545.*

SMILACACEAE

Smilax auriculata Walter – RU & XH; F; *270, 323, 483, 555.*
S. bona-nox L. – FF, UMF, XH & RU; F; *293.*
S. glauca Walter – XH; I; *291.*
S. pumila Walter – UMF & UMF; O; *169.*
S. smallii Morong – RU & XH; O; *590.*

STYRACACEAE

Halesia carolina L. – XH; I; *31, 383, 528.*

SYMPLOCACEAE

Symplocos tinctoria (L.) L'Hér. – UMF; A; *280, 381.*

TETRACHONDRACEAE

Polypremum procumbens L. – SL & SKL; *Hall NV.*

TILIACEAE (see MALVACEAE)

TURNERACEAE

Piriqueta caroliniana (Walter) Urb. – UMF & RU; O; *13, 53, 91.*

ULMACEAE

Planera aquatica Walter *ex* J. F. Gmel. – FS & FF; O; *161, 604.*
Ulmus alata Michx. – FS; O; *162.*
U. americana L. – FS; O; *254.*
U. crassifolia Nutt. – FS; O; *454.*

URTICACEAE

Boehmeria cylindrica (L.) Sw. – SL; O; *470, 577.*

VERBENACEAE

**Lantana camara* L. – XH & RU; *Hall NV.*
Phyla nodiflora (L.) Greene – RU; F; *402.*

VIOLACEAE

Viola palmata L. – XH; I; *233.*
V. sororia Willd. – UMF; I; *158.*

VISCACEAE

Phoradendron leucarpum (Raf.) Reveal & M. C. Johnst. – UMF; O; *274.*

VITACEAE

Ampelopsis arborea (L.) Koehne – FF & UMF; O; *107.*
Parthenocissus quinquefolia (L.) Planch. – FF, UMF, BF & XH; F; *417.*
Vitis aestivalis Michx. – XH; F; *396.*
V. rotundifolia Michx. – UMF & XH; F; *390.*

XYRIDACEAE

**Xyris jupicai* Rich. – FS; O, but locally A on north edge of Meud-Scot track; *441.*
X. platylepis Chapm. – DM; I; *589.*